BIODIVERSITY O.F LAKE VICTORIA:

ITS CONSERVATION AND SUSTAINABLE USE

[THE UGANDAN VERSION]

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Chapter 13

Genetic Status of Selected Fish Taxa In Relation to Conservation of Genetic and Species Diversity in the Victoria and Kyoga Lake Basins·

Changes in the Ecosystem, Genetic Status and Biodiversity of Tilapiines in the Victoria and Kyoga Lake Basins

Genetic Diversity

Biodiversity and Genetic studies of the Cichlids and the Status of Genetic Studies of Non-cichlids of the African Great Lakes region.

Cichlids are known for their explosive radiation especially in the African Great Lakes marked a high level of lake endemism. These fishes have been characterized mainly *along* trophic and habitat differences, by variation in morphological structures such as teeth and jaws and by differences in body shape and coloration. Cichlids are important as a microcosm of macroevolution. The explosive radiation, young evolutionary scale, and the isolation of groups characterized with high levels of endemism and presence of living fossils makes the group important for evolutionary and genetic studies. Lake Victoria region cichlids which are isolated and relatively more recent in evolution were the last to be appreciated in their diversity. Recently Ole Seehausen has found scores of rock fishes in Lake Victoria which were up to then thought to be absent from the Lake and only known to occur in Lakes Malawi and Tanganyika.

Greenwood put together the species groups of Lake Victoria, and later in the early 1980's revised the classification of haplochromine species to reflect the phyletic origin and interrelationship of the various groups in Lake Victoria region. Melan Stiassny has been interested in early evolution of cichlids while the likes of Paul Fuerst and Lees Kaufman and Axel Meyer have been interested and are working to explain the speciation mechanisms responsible for the explosive radiation and evolution of cichlids. Locally S.B Wandera and his student Getrude Narnulemo are spearheading the biodiversity and taxonomic studies of cichlids in Lake Victoria region.

Kaufman is finding a more recent time in the split of groups between lake cichlids and riverine types with a number of specific morphological differences.. The two habitats have been found to be different in the number & diversity of species. Lacustrine waters contain far much bigger species numbers, population sizes and species diversity than rivers

Among the three African Great Lakes are vast varIeties of Cichlid and non-Cichlid species with the Cichlids exhibiting such remarkable endemism and different phylogenetic histories.

Of all the species the haplochromine complexes have the greatest propensity to show the changes that have characterized the three African Great Lakes. Lake Tanganyika contains ancient lineages such as *plyochromis* retlecting its relatively much more ancient origin of 5-12 million years ago, while Lake Malawi is known to be 1.5 million years, Lake Victoria the youngest of the three is thought to have been formed only 750,000 years back and is known to have last completely dried up as recent as 12,000 years habour the youngest of the species complexes.

	Lake Victoria	Lake Malawi	Lake Tanganvika
Haplochromines	~600	~1000	120-150
Tilapias	2	**3-4**	I
Lamprogines	0	0	40 - 70
Non-cichlids	38	>40	120+

In East Africa looking down through Lake Victoria, Lake Malawi and then Lake Tanganyika Cichlid species complexes it offers a masque microscope for evolution. This is though hampered by the problem in identification of the many close related species believed to be flocks especially in the young systems such as lakes Victoria and Malawi. Coloration provides a clue but limited one. Other characters such as dentition have been employed but are tideous and may fail to differentiate taxa at the species level in such cases as of trophically generalized complexes. There is also limitation in that combination of coloration and dentition as taxonomic tools they has to encompass all variation, and this requires tremendous amount of knowledge of the vast variety of species. In some species complexes understanding the difference in tooth structure requires studies of ontogenetic development of the contained species. Some species because in some cases are known to have arisen by arresting the development at different stages of the generalised types a phenomenon Greenwood termed species that are known to have given rise to a multitude of others through such phenomenon as factory types. These factory prototypes have been found to be morphologically plastic with substantial propensity to change.

Kaufman has categorised the species complexes of Lake Victoria region into three main groups according to their ecology and phyletic relationship.
Matrix taxa - these are wide spread in rivers and occasionally invade lakes. These include groups such as *Pseudocrenilabrus, Astatoreochromis, Astatotilapia bloyeti*
Explosive taxa - lacustrine in nature and are common in the disturbed lakes. They are hypothesised to be progenitors and exhibit high levels of adaptive divergence. For example the lacustrine *Astatotilapia spp* and *Paralabidochromis spp.* These groups have been likened to the stickle back fishes which also show enormous adaptive divergence.
Fragile taxa - are usually characterised by rapid speciation without adaptive change. Speciation is achieved through little movements of fishes and by mechanisms such-as the original refilling of the Lake Victoria after the drying up. According to Greenwood's list, Lake Victoria region is known to contain nearly 200 known and described species,

approximately 200 known but undescribed species, nearly 200 known with no archival data, and an infinite numbcr of unknown species.

Lake Victoria prior to 1980 was characterised mainly by fragile taxa but by late 1980s explosive taxa started to dominate the system. Satellite lakes such as Lake Nawampasa have been found to have species complexes equivalent to original Lake Victoria groups prior to the 1980's. While Lakes Edward and George contain cichlid species mainly at the fragile taxa stage.

With development of new tools, such as molecular methods, various local and international scientists are looking to collaborate with the morphologists and taxonomists in an attempt to describe remaining taxa and clarify on questions and issues that have been contentious in cichlid studies especially their phylogeny and mechanisms of origin. Molecular tools are also being employed to study genetic population structures of commercially important as well as species such as *Asratoreochromis alluaudii* which represent major species complexes in the region.

Incorporation of molecular methods in the study of haplochromines and cichlids in general will hasten genetic studies and collaborate findings of the morphological and ecological work. In view of limited resources, clearer differentiation among species/population ecologically or evolutionary is a prerequisite to the effective management of fish biodiversity in African Great Lakes Region amid other competing needs such economic activities on the respective water bodies. Molecular tools provide a much fine differentiation and clear relationships among taxa as many of these molecular tools have been shown not to be affected by environmental differences and ecological changes.
The state of the genetic studies in the all African great lakes despite the huge interest is still poor. Of recent international collaboration interests and collaborators has led to increase in genetic studies for cichlids In a much worse state is the status or genetic studies of non-cichlids in which only a few species have been genetically studied even by international scientists yet in all of the African Great Lakes non-cichlids species are or were of great commercial importance and in most cases fonned the main stay of the fishery.

Several other non--cichlid species are currently ranked as threatened or endangered in LakeVictoria region. A whole range of *Barbus*, cat fishes and labeines are in quite ecologically poor state. The *Labeo* which once fonned the main riverine fishery and produced over 250 tonnes annually has been relegated to small pockets within the lake *Barbus altianalis* originally second to Ningu in riverine fishes has also crumpled and is currently a rare occurrence. For several of such species we can alternatively manage, conserve or ever develop them if we can show that there are still ecologically and. genetically viable.

Changes in Ecology, Genetics and Biodiversity of Tilapiine Species **in** the Victoria Lake Basin.

Prior to the 1960s the two native species of Lake Victoria region *Oreochromis esculentus* and *Oreochromis variabilis* fonned the mainstay of the fishery. Increased fishing pressure due to increased fish demand and use of more efficient fishing gear led to the collapse of the native Tilapiine fishery. Efforts to augment the fishery stocks were initiated as early as the 1930s after the Graham's fisheries survey report of Lake Victoria. Since then non indigenous tilapiines species and eventually the Nile perch were introduced.

Overflshing and mal-exploitation were the key factors in the collapse of the native tilapiine species. Establishment of the non-indigenous species which included the predatory Nile perch and Nile tilapia served to further curtail the recovery of the indigenous forms. *Oreochromis esculentus* has completely displaced from Lake Victoria and Kyoga and is only found in few of the minor satellite lakes around Victoria and Kyoga. O. *variabilis* has been relegated to small pockets within Lake Victoria but completely displaced out of Lake Kyoga. It is still extant in section of the Nile between Lake Victoria and Lake Kyoga and in several of the minor satellite dams around Lake Kyoga.

Limnological changes witnessed since the increased lake levels of the early 1960s from a predominathly diatomous Lakes Kyoga and Victoria to blue green lakes also served to alieniate the native tilapiine species further whose diet was comprised largely of diatoms. Nile tilapia can use blue greens while *esculenlus* carmot.

Of the non indegenous species. 0. *leucostictus* and *T zilli* were the most prevatent in Lake Victoria by the early I960s. These were easily outcompeted and reduced to freq uent but non domiant status as more more abundant Nile tilapia which together with Nile perch forms the main stay of the lishery in Lake Victoria Regional became established. Nile tilapia now occurs in almost all waters in the region save for some few minor lakes. Other species include, *Tilapia rendali* which is of rare occurrence. Genetic analysis of Tilapiines has shown the Nile tilapia to most variable while 0. *esculenlus* turned out to be the least variable. This is certainly a generalized observations but there are lakes especially where 0. *esculenlus* does not coexist with any other Tilapiine and is of sizeable population, shows relatively high genetic variability. Most of the populations of the native tilapiine species and other introduced species with the exception of 0. *nilolicus* exhibit high population subdivision as distinctivess. A situation attributed to seine reduction in population size and isolation of the remnant population.

Another issue of concern is loss of variability and increased in-breeding levels sizes. Thus reduction in species in what would be heavens of the remnant populations of native tilapiines is excessive fishing pressure on the minor satellite lakes. This decrease in population size and in isolation of population units curtails general flow and makes species valuable to effects of inbreeding.

Another problem is the founder. Many of Tilapiine species including native species were introduced on several of the satellite lakes from a small base. Only small part of the origin variation was used to establish these populations. Our results have shown

population units to be relatively less variable and very distinct from each other. And perhaps would served better when treated as distinct populations than a sign species unit.

Efforts should be made to regulate National movement of life specimens of fish species and ban deliberate introductions that are not based on clear understanding of the fish population structure and ecology. Perhaps dividing populations can be boosted through hatchery science conducted in such a way that it maximizes variability